Part I
Getting Started

Chapter 3
Integrating Pollution Prevention

Contents

Integrating Pollution Prevention

This chapter will help you:

- *Consider pollution prevention options when designing a waste management system. Pollution prevention will reduce waste disposal needs and can minimize impacts across all environmental media. Pollution prevention can also reduce the volume and toxicity of waste. Lastly, pollution prevention can ease some of the burdens, risks, and liabilities of waste management.*

Pollution prevention describes a variety of practices that go beyond traditional environmental compliance or single media permits for water, air, or land disposal and begin to address the concept of sustainability in the use and reuse of natural resources. Adopting pollution prevention policies and integrating pollution prevention into operations provide opportunities to reduce the volume and toxicity of wastes, reduce waste disposal needs, and recycle and reuse materials formerly handled as wastes. In addition to potential savings on waste management costs, pollution prevention can help improve the interactions among industry, the public, and regulatory agencies. It can also reduce liabilities and risks associated with releases from waste management units and closure and post-closure care of waste management units.

This chapter will help address the following questions.

- What are some of the benefits of pollution prevention?
- Where can assistance in identifying and implementing specific pollution prevention options be obtained?

Pollution prevention is comprehensive. It emphasizes a life-cycle approach to assessing a facility's physical plant, production processes, and products to identify the best opportunities to minimize environmental impacts across all media. This approach also ensures that actions taken in one area will not increase environmental problems in another area, such as reducing wastewater discharges but increasing airborne emissions of volatile organic compounds. Pollution prevention requires creative problem solving by a broad cross section of employees to help achieve environmental goals. In addition to the environmental benefits, implementing pollution prevention can often benefit a company in many other ways. For example, redesigning production processes or finding alternative material inputs can also improve product quality, increase efficiency, and conserve raw materials. Some common examples of pollution prevention activities include: redesigning

processes or products to reduce raw material needs and the volume of waste generated; replacing solvent based cleaners with aqueous based cleaners or mechanical cleaning systems; and instituting a reverse distribution system where shipping packaging is returned to the supplier for reuse rather than discard.

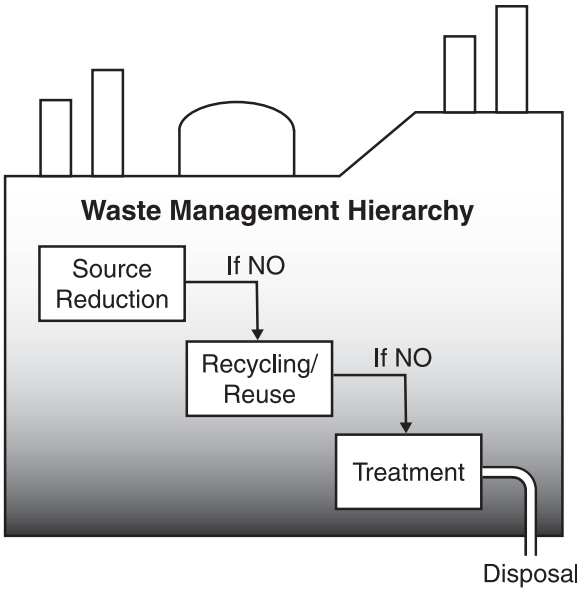
The Pollution Prevention Act of 1990 established a national policy to first, prevent or reduce waste at the point of generation (source reduction); second, recycle or reuse waste materials; third, treat waste; and finally, dispose of remaining waste in an environmentally protective manner (see Figure 1). Some states and many local governments have adopted similar policies, often with more specific and measurable goals.

Source Reduction means any practice which (i) reduces the amount of any substance, pollutant, or contaminant entering any wastestream or otherwise released into the environment, prior to recycling, treatment, or disposal; and (ii) reduces the risks to public health and the environment associated with the release of such substances, pollutants, or contaminants.

Recycling requires an examination of waste streams and production processes to identify opportunities. Recycling and beneficially reusing wastes can help reduce disposal costs, while using or reusing recycled materials as substitutes for feedstocks can reduce raw materials costs. Materials exchange programs can assist in finding uses for recycled materials and in identifying effective substitutes for raw materials. Recycling not only helps reduce the overall amount of waste sent for disposal, but also helps conserve natural resources by replacing the need for virgin materials.

Treatment can reduce the volume and toxicity of a waste. Reducing a waste's volume and toxicity prior to final disposal can result in long-term cost savings. There are a considerable number of levels and types of treatment from which to choose. Selecting the right treatment option can help simplify disposal options and limit future liability.

Figure 1. Waste Management Hierarchy



Over the past 10 years, interest in all aspects of pollution prevention has blossomed, and governments, businesses, academic and research institutions, and individual citizens have dedicated greater resources to it. Many industries are adapting pollution prevention practices to fit their individual operations. Pollution prevention can be successful when flexible problem-solving approaches and solutions are implemented. Fitting these steps into your operation's business and environmental goals will help ensure your program's success.

Throughout the Guide several key steps are highlighted that are ideal points for implementing pollution prevention to help reduce waste management costs, increase options, or reduce potential liabilities by reducing risks that the wastes might pose. For example:

Waste characterization is a key component of the Guide. It is also a key component of a pollution prevention opportunity assessment. An opportunity assessment, however, is more comprehensive since it also covers material inputs, production processes, operating practices, and potentially other areas such as inventory control. When characterizing a waste, consider expanding the opportunity assessment to cover these aspects of the business. An opportunity assessment can help identify the most efficient, cost-effective, and environmentally friendly combination of options, especially when planning new products, new or changed waste management practices, or facility expansions.

Land application of waste might be a preferred waste management option because land application units can manage wastes with high liquid content, treat wastes through biodegradation, and improve soils due to the organic material in the waste. Concentrations of constituents might limit the ability to take full advantage of land application. Reducing the concentrations of constituents in the waste before it is generated or treating the waste prior to land application can provide the flexibility to use land application and ensure that the practice will be protective of human health and the environment and limit future liabilities.

I. Benefits of Pollution Prevention

Pollution prevention activities benefit industry, states, and the public by protecting the environment and reducing health risks, and also provide businesses with financial and strategic benefits.

Protecting human health and the environment. By reducing the amount of contaminants released into the environment and the volume of waste requiring disposal, pollution prevention activities protect human health and the environment. Decreasing the volume or toxicity of process materials and wastes can reduce worker exposure to potentially harmful constituents. Preventing the release and disposal of waste constituents to the environment also reduces human and wildlife exposure and habitat degradation. Reduced consumption of raw materials and energy conserves precious natural resources. Finally reducing the volume of waste generated decreases the need for construction of new waste management facilities, preserving land for other uses such as recreation or wildlife habitat.

Cost savings. Many pollution prevention activities make industrial processes and equipment more resource-efficient. This increased production efficiency saves raw material and labor costs, lowers maintenance costs due to newer equipment, and potentially lowers oversight costs due to process simplification. When planning pollution prevention activities, consider the cost of the initial investment for audits, equipment, and labor. This cost will

vary depending on the size and complexity of waste reduction activities. In addition, consider the payback time for the investment. Prioritize pollution prevention activities to maximize cost savings and health and environmental benefits.

Simpler design and operating conditions. Reducing the risks associated with wastes can allow wastes to be managed under less stringent design and operating conditions. For example, the ground-water tool in Chapter 7, Section A – Assessing Risk might indicate that a composite liner is recommended for a specific waste stream. A pollution prevention opportunity assessment also might imply that by implementing a pollution prevention activity that lowers the concentrations of one or two problematic waste constituents in that waste stream, a compacted clay liner can provide sufficient protection. When the risks associated with waste disposal are reduced, the long-term costs of closure and post-closure care can also be reduced.

Improved worker safety. Processes involving less toxic and less physically dangerous materials can improve worker safety by reducing work-related injuries and illnesses. In addition to strengthening morale, improved worker safety also reduces health-related costs from lost work days, health insurance, and disability payments.

Lower liability. A well-operated unit minimizes releases, accidents, and unsafe waste-handling practices. Reducing the volume and toxicity of waste decreases the impact of these events if they occur. Reducing potential liabilities decreases the likelihood of litigation and cleanup costs.

Higher product quality. Many corporations have found that higher product quality results from some pollution prevention efforts. A significant part of the waste in some operations consists of products that fail quality inspections, so minimizing waste in those cases is inextricably linked with process changes that improve quality. Often, managers do not realize how easy or technically feasible such changes are until the drive for waste reduction leads to exploration of the possibilities.

Building community relations. Honesty and openness can strengthen credibility between industries, communities, and regulatory agencies. If you are implementing a pollution prevention program, make people aware of it. Environmental protection and economic growth can be compatible objectives. Additionally, dialogue among all parties in the development of pollution prevention plans can help identify and address concerns.

II. Implementing Pollution Prevention

When implementing pollution prevention, consider a combination of options that best fits your facility and its products. There are a number of steps common to implementing any facility-wide pollution prevention effort. An essential starting point is to make a clear commitment to identifying and taking advantage of pollution prevention opportunities. Seek the participation of interested partners, develop a policy statement committing the industrial operation to pollution prevention, and organize a team to take responsibility for it. As a next step, conduct a thorough pollution prevention opportunity assessment. Such an assessment will help set priorities according to which options are the most promising. Another feature common to many pollution prevention programs is measuring the program's progress.

The actual pollution prevention practices implemented are the core of a program. The following sections give a brief overview of these core activities: source reduction, recycling, and treatment. To find out more, contact some of the organizations listed throughout this chapter.

A. Source Reduction

As defined in the Pollution Prevention Act of 1990, source reduction means any practice which (i) reduces the amount of any hazardous substance, pollutant, or contaminant entering any wastestream or otherwise released into the environment, prior to recycling, treatment, or disposal; and (ii) reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants. The term includes equipment or technology modifications; process or procedure modifications; reformulations or redesign of products; substitution of raw materials; and improvements in housekeeping, maintenance, training, or inventory control.

Reformulation or redesign of products. One source reduction option is to reformulate or redesign products and processes to incorporate materials more likely to produce lower-risk wastes. Some of the most common practices include eliminating metals from inks, dyes, and paints; reformulating paints, inks, and adhesives to eliminate synthetic organic solvents; and replacing chemical-based cleaning solvents with water-based or citrus-based products. Using raw materials free from even trace quantities of contaminants, whenever possible, can also help reduce waste at the source.

When substituting materials in an industrial process, it is important to examine the effect on the entire waste stream to ensure that the overall risk is being reduced. Some changes can shift contaminants to another medium rather than actually reduce waste generation. Switching from solvent-based to water-based cleaners, for example, will reduce solvent volume and disposal cost, but is likely to dramatically increase wastewater volume. Look at the impact of wastewater generation on effluent limits and wastewater treatment sludge production.

Technological modifications. Newer process technologies often include better waste reduction features than older ones. For industrial processes that predate considera-

tion of waste and risk reduction, adopting new procedures or upgrading equipment can reduce waste volume, toxicity, and management costs. Some examples include redesigning equipment to cut losses during batch changes or during cleaning and maintenance, changing to mechanical cleaning devices to avoid solvent use, and installing more energy- and material-efficient equipment. State technical assistance centers, trade associations, and other organizations listed in this chapter can help evaluate the potential advantages and savings of such improvements.

In-process recycling (reuse). In-process recycling involves the reuse of materials, such as cutting scraps, as inputs to the same process from which they came, or uses them in other processes or for other uses in the facility. This furthers waste reduction goals by reducing the need for treatment or disposal and by conserving energy and resources. A common example of in-process recycling is the reuse of wastewater.

Good housekeeping procedures. Some of the easiest, most cost-effective, and most widely used waste reduction techniques are simple improvements in housekeeping. Accidents and spills generate avoidable disposal hazards and expenses. They are less likely to occur in clean, neatly organized facilities.

Good housekeeping techniques that reduce the likelihood of accidents and spills include training employees to manage waste and materials properly; keeping aisles wide and free of obstructions; clearly labeling containers with content, handling, storage, expiration, and health and safety information; spacing stored materials to allow easy access; surrounding storage areas with containment berms to control leaks or spills; and segregating stored materials to avoid cross-contamination, mixing of incompatible materials, and unwanted reactions. Proper employee training is crucial to implementing a successful waste reduction program, especially one featuring good housekeeping procedures. Case study data indicate that effective employee training programs can reduce waste disposal volumes by 10 to 40 percent.[1]

Regularly scheduled maintenance and plant inspections are also useful. Maintenance helps avoid the large cleanups and disposal operations that can result from equipment failure. Routine maintenance also ensures that equipment is operating at peak efficiency, saving energy, time, and materials. Regularly scheduled or random, unscheduled plant inspections help identify potential problems before they cause waste management problems. They also help identify areas where improving the efficiency of materials management and handling practices is possible. If possible, plant inspections, periodically performed by outside inspectors who are less familiar with day-to-day plant operations, can bring attention to areas for improvement that are overlooked by employees accustomed to the plant's routine practices.

Storing large volumes of raw materials increases the risk of an accidental spill and the likelihood that the materials will not be used due to changes in production schedules, new product formulations, or material degradation. Companies are sometimes forced to dispose of materials whose expiration dates have passed or that are no longer needed. Efficient inventory control allows a facility to avoid stocking materials in excess of its ability to use them, thereby decreasing disposal volume and cost. Many companies have successfully implemented "just-in-time" manufacturing systems to avoid the costs and risks associated with maintaining a large onsite inventory. In a "just-in-time" manufacturing system, raw materials arrive as they are needed and only minimal inventories are maintained on site.

[1] Freeman, Harry. 1995. *Industrial Pollution Prevention Handbook*. McGraw-Hill, Inc. p. 13.

Segregating waste streams is another good housekeeping procedure that enables a facility to avoid contaminating lower risk wastes with hazardous constituents from another source. Based on a waste characterization study, it might be more efficient and cost-effective to manage wastes separately by recycling some, and treating or disposing of others. Waste segregation can also help reduce the risks associated with handling waste. Separating waste streams allows some materials to be reused, resulting in additional cost savings. Emerging markets for recovered industrial waste materials are creating new economic incentives to segregate waste streams. Recovered materials are more attractive to potential buyers if it can be ensured that they are not tainted with other waste materials. For example, if wastes from metal-finishing facilities are segregated by type, metal-specific-bearing sludge can be recovered more economically and the segregated solvents and waste oils can be recycled.

B. Recycling

Recycling involves collecting, processing, and reusing materials that would otherwise be handled as wastes. The following discussion highlights a few of the ways to begin this process.

Materials exchange programs. Many local governments and states have established materials exchange programs to facilitate transactions between waste generators and industries that can use wastes as raw materials. Materials exchanges are an effective and inexpensive way to find new users and uses for a waste. Most are publicly funded, nonprofit organizations, although some charge a nominal fee to be listed with them or to access their online databases. Some actively work to promote exchanges between generators and users, while others simply publish lists of generators, materials, and buyers. Some waste exchanges also sponsor workshops and conferences to discuss waste-related regulations and to exchange information. More than 60 waste and materials exchanges operate in North America. Below are four examples of national, state, and local exchange programs. Each program's Web site also provides links to other regional, national, and international materials exchange networks.

- EPA's Jobs Through Recycling (JTR) Web site **<www.epa.gov/jtr/comm/exchange.htm>** provides descriptions of and links to international, national, and state-specific materials exchange programs and organizations.
- Recycler's World **<www.recycle.net/exch/index.html>** is a world-wide materials trading site with links to dozens of state and regional exchange networks.
- CalMAX (California Materials Exchange) **<www.ciwmb.ca.gov/calmax>** is maintained by the California Integrated Waste Management Board and facilitates waste exchanges in California and provides links to other local and national exchange programs.
- King County, Washington's IMEX **<www.metrokc.gov/hazwaste/imex/exchanges.html/>** is a local industrial materials exchange program that also provides an extensive list of state, regional, national, and international exchange programs.

Beneficial use. Beneficial use involves substituting a waste material for another material with similar properties. Utility companies, for example, often use coal combustion ash as a construction material, road base, or soil stabilizer. The ash replaces other, non-

recycled materials, such as fill or Portland cement, not only avoiding disposal costs but also generating revenue. Other examples of beneficial use include using wastewaters and sludges as soil amendments (see Chapter 7, Section C–Designing a Land Application Program) and using foundry sand in asphalt, concrete, and roadbed construction.

Many regulatory agencies require approval of planned beneficial use activities and may require testing of the materials to be reused. Others may allow certain wastes to be designated for beneficial use, as long as the required analyses are completed. Pennsylvania, for example, allows application of a "coproduct" designation to, and exemption from waste regulations for "materials which are essentially equivalent to and used in place of an intentionally manufactured product or produced raw material and... [which present] no greater risk to the public or the environment." Generally, regulatory agencies want to ensure that any beneficially used materials are free from significantly increased levels of constituents that might pose a greater risk than the materials they are replacing. Consult with the state agency for criteria and regulations governing beneficial use.

In a continuing effort to promote the use of materials recovered from solid waste, the Environmental Protection Agency (EPA) has instituted the Comprehensive Procurement Guideline (CPG) program. Using recycled-content products ensures that materials collected in recycling programs will be used again in the manufacture of new products. The CPG program is authorized by Congress under Section 6002 of the Resource Conservation and Recovery Act (RCRA) and Executive Order 13101. Under the CPG program, EPA is required to designate products that are or can be made with recovered materials and to recommend practices for buying these products. Once a product is designated, procuring agencies are required to purchase it with the highest recovered material content level practicable. As of January 2001, EPA has designated 54 items within eight product categories including items such as retread tires, cement and concrete containing coal fly ash and ground granulated blast furnace slag, traffic barricades, playground surfaces, landscaping products, and nonpaper office products like binders and toner cartridges. While directed primarily at federal, state, and local procuring agencies, CPG information is helpful to everyone interested in purchasing recycled-content products. For further information on the CPG program, visit: **<www.epa.gov/cpg>**.

C. Treatment

Treatment of non-hazardous industrial waste is not a federal requirement, however, it can help to reduce the volume and toxicity of waste prior to disposal. Treatment can also make a waste amenable for reuse or recycling. Consequently, a facility managing non-hazardous industrial waste might elect to apply treatment. For example, treatment might be incorporated to address volatile organic compound (VOC) emissions from a waste managment unit, or a facility might elect to treat a waste so that a less stringent waste management system design could be used. Treatment involves changing a waste's physical, chemical, or biological character or composition through designed techniques or processes. There are three primary categories of treatment—physical, chemical, and biological.

Physical treatment involves changing the waste's physical properties such as its size, shape, density, or state (i.e., gas, liquid, solid). Physical treatment does not change a waste's chemical composition. One form of physical treatment, immobilization, involves encapsulating waste in other materials, such as plastic, resin, or cement, to prevent constituents from volatilizing or leaching. Listed below are a few examples of physical treatment.

- Immobilization:
  Encapsulation
  Thermoplastic binding
- Carbon absorption:
  Granular activated carbon (GAC)
  Powdered activated carbon (PAC)
- Distillation:
  Batch distillation
  Fractionation
  Thin film extraction
  Steam stripping
  Thermal drying
- Filtration
- Evaporation/volatilization
- Grinding
- Shredding
- Compacting
- Solidification/addition of absorbent material

Chemical treatment involves altering a waste's chemical composition, structure, and properties through chemical reactions. Chemical treatment can consist of mixing the waste with other materials (reagents), heating the waste to high temperatures, or a combination of both. Through chemical treatment, waste constituents can be recovered or destroyed. Listed below are a few examples of chemical treatment.

- Neutralization
- Oxidation
- Reduction
- Precipitation
- Acid leaching
- Ion exchange
- Incineration
- Thermal desorption
- Stabilization
- Vitrification
- Extraction:
  Solvent extraction
  Critical extraction
- High temperature metal recovery (HTMR)

Biological treatment can be divided into two categories–aerobic and anaerobic. Aerobic biological treatment uses oxygen-requiring microorganisms to decompose organic and non-metallic constituents into carbon dioxide, water, nitrates, sulfates, simpler organic products, and cellular biomass (i.e., cellular growth and reproduction). Anaerobic biological treatment uses microorganisms, in the absence of oxygen, to transform organic constituents and nitrogen-containing compounds into oxygen and methane gas ($CH_4(g)$). Anaerobic biological treatment typically is performed in an enclosed digestor unit. Listed below are a few examples of biological treatment.

- Aerobic:
  Activated sludge
  Aerated lagoon
  Trickling filter
  Rotating biological contactor (RBC)
- Anaerobic digestion

The range of treatment methods from which to choose is as diverse as the range of wastes to be treated. More advanced treatment will generally be more expensive, but by reducing the quantity and risk level of the waste, costs might be reduced in the long run. Savings could come from not only lower disposal costs, but also lower closure and post-closure care costs. Treatment and post-treatment waste management methods can be selected to minimize both total cost and environmental impact, keeping in mind that treatment residuals, such as sludges, are wastes themselves that will need to be managed.

III. Where to Find Out More: Technical and Financial Assistance

There is a wealth of information available to help integrate pollution prevention into an operation. As a starting point, a list of references to technical and financial resources is included in this section. The Internet can be an excellent source of background information on the various resources to help begin the search for assistance. Waste reduction information and technologies are constantly changing. To follow new developments you should maintain technical and financial contacts and continue to use these resources even after beginning waste reduction activities. Eventually, you can build a network of contacts to support all your various technical needs.

Where Can Assistance Be Obtained?

Several types of organizations offer assistance. These include offices in regulatory agencies, university departments, nonprofit foundations, and trade associations. Additionally, the National Institute of Standards and Technology (NIST) Manufacturing Extension Partnerships (MEPs) **<www.mep.nist.gov>** also provide waste reduction information. Look for waste reduction staff within the media programs (air, water, solid/hazardous waste) of regulatory agencies or in the state commissioner's office, special projects division, or pollution prevention division. Some states also provide technical assistance for waste reduction activities, such as recycling, through a business advocate or small business technical assistance program. EPA's U.S. State & Local Gateway Web site **<www.epa.gov/epapages/statelocal/envrolst.htm>** is a helpful tool for locating your state environmental agency.

The listings below identify some primary sources for technical assistance that might prove helpful. This list serves as a starting point only and is by no means exhaustive. There are many additional organizations that offer pollution prevention assistance on regional, state, and local levels.

- **American Forest and Paper Association (AF&PA)** is the national trade association of the forest, paper, and wood products industries. It offers documents that might help you find buyers for wood and paper wastes. **<www.afandpa.org>** Phone: 800 878-8878 e-mail: INFO@afandpa.ccmail.compuserve.com
- **California Integrated Waste Management Board.** This Web site contains general waste prevention background and business waste reduction program overviews, fact sheets, and information about market development for recycled materials and waste reduction training. **<www.ciwmb.ca.gov/WPW>**
- **Center for Environmental Research Information (CERI)** provides technical guides and manuals on waste reduction, summaries of pollution prevention opportunity assessments,

and waste reduction alternatives for specific industry sectors. **<www.epa.gov/ttbnrmrl/ttmat.htm>** Phone: 513-569-7562 e-mail: ord.ceri@epamail.epa.gov

- **Enviroene**, part of the U.S. EPA's Web site, provides a single repository for pollution prevention, compliance assurance, and enforcement information and data bases. Its search engine searches multiple Web sites (inside and outside the EPA), and offers assistance in preparing a search. **<es.epa.gov>**
- **National Pollution Prevention Roundtable (NPPR)** promotes the development, implementation, and evaluation of pollution prevention. NPPR's Web site provides an abridged online version of *The Pollution Prevention Yellow Pages* **<www.p2.org/inforesources/nppr_yps.html>**, a listing of local, state, regional and national organizations, including state and local government programs, federal agencies, EPA pollution prevention coordinators, and non-profit groups that work on pollution prevention. **<www.p2.org>** Phone: 202 466-P2P2
- **P2 GEMS.** This site, an Internet search tool operated by the Massachusetts Toxics Use Reduction Institute, can help facility planners, engineers, and managers locate process and materials management information over the Web. It includes information on over 550 sites valuable for toxics use reduction planning and pollution prevention. **<www.edu/p2gems.org>**
- **Pollution Prevention Information Clearinghouse (PPIC).** PPIC maintains a collection of EPA non-regulatory documents related to waste reduction. **<www.epa.gov/opptintr/library/libppic.htm>** Phone: 202 260-1023 e-mail: ppic@epamail.epa.gov
- **U.S. Department of Energy (DOE) Industrial Assessment Centers (IACs).** DOE's Office of Industrial Technologies sponsors free industrial assessments for small and medium-sized manufacturers. Teams of engineering students from the centers conduct energy audits or industrial assessments and provide recommendations to manufacturers to help them identify opportunities to improve productivity, reduce waste, and save energy. **<www.oit.doe.gov/iac>**

What Types of Technical Assistance Are Available?

Many state and local governments have technical assistance programs that are distinct from regulatory offices. In addition, non-governmental organizations conduct a wide range of activities to educate businesses about the value of pollution prevention. These efforts range from providing onsite technical assistance and sharing industry-specific experiences to conducting research and developing education and outreach materials on waste reduction topics. The following examples illustrate what services are available:

- **NIST technical centers.** There are NIST-sponsored Manufacturing Technology Centers throughout the country as part of the grassroots Manufacturing Extension Partnership (MEP) program. The MEP program helps small and medium-sized companies adopt new waste reduction

technologies by providing technical information, financing, training, and other services. The NIST Web site **<www.nist.gov>** has a locator that can help you find the nearest center.

- **Trade associations.** Trade associations provide industry-specific assistance through publications, workshops, field research, and consulting services. EPA's WasteWise program **<www.ergweb.com/wwta/intro.asp>** provides an online resources directory which can help you locate specific trade associations. The National Trade and Professional Associations of the Unites States' *Directory of Trade Associations* (Washington, DC: Columbia Books, Inc., 2000) is another useful resource.
- **Onsite technical assistance audits.** These audits are for small (and sometimes larger) businesses. The assessments, which take place outside of the regulatory environment and on a strictly voluntary basis, provide businesses with information on how to save money, increase efficiency, and improve community relations. DOE's Office of Industrial Technologies **<www.oit.doe.gov/iac>** provides such assessments for small and medium-sized manufacturers.
- **Information clearinghouses.** Many organizations maintain repositories of waste reduction information and serve as starting points to help businesses access this information. EPA's Pollution Prevention Information Center (PPIC) **<www.epa.gov/opptintr/library/libppic.htm>** is one example.
- **Facility planning assistance.** A number of organizations can help businesses develop, review, or evaluate facility waste reduction plans. State waste reduction programs frequently prepare model plans designed to demonstrate activities a business can implement to minimize waste.
- **Research and collaborative projects.** Academic institutions, state agencies and other organizations frequently participate in research and collaborative projects with industry to foster development of waste reduction technologies and management strategies. Laboratory and field research activities include studies, surveys, database development, data collection, and analysis.
- **Hotlines.** Some states operate telephone assistance services to provide technical waste reduction information to industry and the general public. Hotline staff typically answer questions, provide referrals, and distribute printed technical materials on request.
- **Computer searches and the Internet.** The Internet brings many pollution prevention resources to a user's fingertips. The wide range of resources available electronically can provide information about innovative waste-reducing technologies, efficient industrial processes, current state and federal regulations, and many other pertinent topics. Independent searches can be done on the Internet, and some states perform computer searches to provide industry with information about waste reduction. EPA and many state agencies have Web sites dedicated to these topics, with case studies, technical explanations, legal information, and links to other sites for more information.

- **Workshops, seminars, and training.** State agencies, trade associations, and other organizations conduct workshops, seminars, and technical training on waste reduction. These events provide information, identify resources, and facilitate networking.
- **Grants and loans.** A number of states distribute funds to independent groups that conduct waste reduction activities. These groups often use such support to fund research and to run demonstration and pilot projects.

Integrating Pollution Prevention Activity List

To address pollution prevention you should:

- ❑ Make waste management decisions by considering the priorities set by the full range of pollution prevention options—first, source reduction; second, reuse and recycling; third, treatment; last, disposal.
- ❑ Explore the cost savings and other benefits available through activities that integrate pollution prevention.
- ❑ Develop a waste reduction policy.
- ❑ Conduct a pollution prevention opportunity assessment of facility processes.
- ❑ Research potential pollution prevention activities.
- ❑ Consult with public and private agencies and organizations providing technical and financial assistance for pollution prevention activities.
- ❑ Plan and implement activities that integrate pollution prevention.

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